November 1974

B74-10198

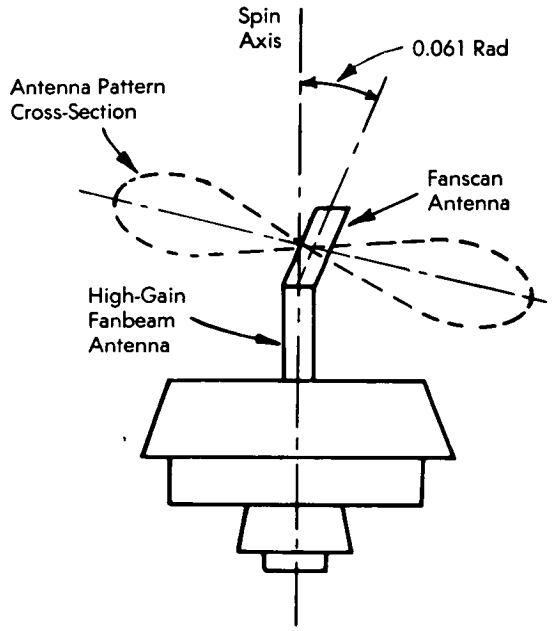
NASA TECH BRIEF

Ames Research Center

Spacecraft Attitude Determination by Fanscan Technique

The problem:

To determine the orientation, or attitude, of a spacecraft in flight relative to the data-receiving antenna on earth.



The solution:

Utilize a fanbeam antenna which is offset in angle from the spin axis of the spacecraft and provides a fan-like radiation pattern (i.e., fanscan).

How it's done:

In a typical configuration for an orbiting spacecraft, there are two antennas as shown in the diagram, one being an on-axis fanbeam for downlink communications. The other antenna is the offset fanbeam for both uplink communication and the attitude determination; the offset produces a signal loss of about 1 dB, typically. If the spin axis of the spacecraft is perpendicular to the Earth line, the received signal will exhibit an amplitude modulation at twice the spin frequency, with an index proportional to the offset angle. If the spin axis is offset from the plane normal to the Earth line, the automatic gain control signal from the receiver will contain a component at the spin frequency with an amplitude which is a function of the pointing error.

The fanscan antenna is a 61-cm Franklin array with a maximum gain of 7.5 dB and a half-power beamwidth of 0.21 rad. Its axis is set at an angle of 0.061 rad from the spin axis of the spacecraft.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Ames Research Center
Moffett Field, California 94035
Reference: TSP 74-10198

Patent status:

NASA has decided not to apply for a patent.

Source: Herbert A. Lassen and
Jorge H. Decanini of
TRW Systems Group, TRW, Inc.
under contract to
Ames Research Center
(ARC-10827)

Category 02